Pre- and post-assessment for Unit 1: Order of Operations and Whole Numbers

Dear 5th Grade Student,

Please complete the following problems to the best of your ability. You may or may not know the solutions. Just try your best. Please show all your work because we want to know how you think about mathematics. Thank you. ☺

1) $8 + 4 = \boxed{9} + 3$ $\quad 8+4=9+3$

2) $5 + 3 \times 4 = \boxed{17}$

3) Add the correct operations to make this a true statement

$$24 \div 3 + 2 = 10$$

4) Evaluate the following numerical expressions.
   a. $2\,(5 + (3)\,(2) + 4)$
   b. $2\,((5+3)\,(2+4))$
   c. $2\,(5+3\,(2+4))$

   Can the parentheses in any of these expressions be removed without changing the value the expression?

Solution:

a. $2(5+(3)(2)+4)$ We may evaluate this expression in two ways:

   Distributing the lead constant first:

   $$2\cdot5+2\cdot3\cdot2+2\cdot4=10+12+8=30$$

   or distributing the lead constant last:

   $$2(5+6+4) = 2\cdot15=30.$$

Either way, we first have to multiply (3)(2)=6 before adding any of the terms. The parentheses in the middle are not necessary. Instead of writing (3)(2) we can say $3 \cdot 2$.

b. Notice that in the expression 2((5+3)(2+4)) , the outer set of parentheses are not necessary:

$$2((5+3)(2+4))=2(5+3)(2+4).$$

The other parentheses are necessary since they indicate that we first have to perform the additions inside these parentheses:

$$2(5+3)(2+4)=2(8)(6)=96.$$

c.

In this expression we complete the operations from the inside out. The inner most addition must occur first, then the inner multiplication, then the secondary addition and finally the outer multiplication:

$$2(5+3(2+4))=2(5+3(6))=2(5+18)=2(23)=46.$$

In this expression all parentheses are needed.

5) Write an expression that records the calculations described below, but do not evaluate.

Add 2 and 4 and multiply the sum by 3. Next, add 5 to that product and then double the result. *Example solution:* *2 [3(2+4) +5]*

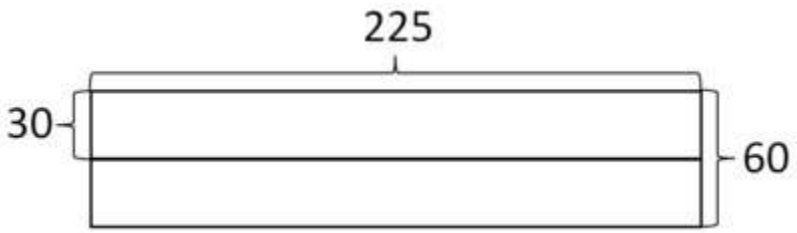
6) Leo and Silvia are looking at the following problem:

How does the product of 60×225 compare to the product of 30×225?
Silvia says she can compare these products without multiplying the numbers out. Explain how she might do this. Draw pictures to illustrate your explanation.

Since 60 is twice 30, the product 60×225 is twice the product 30×225. We can write this as an equation:

$$60\times225= (2\times30) \times225=2\times (30\times225).$$

The above explanation corresponds to the following picture.



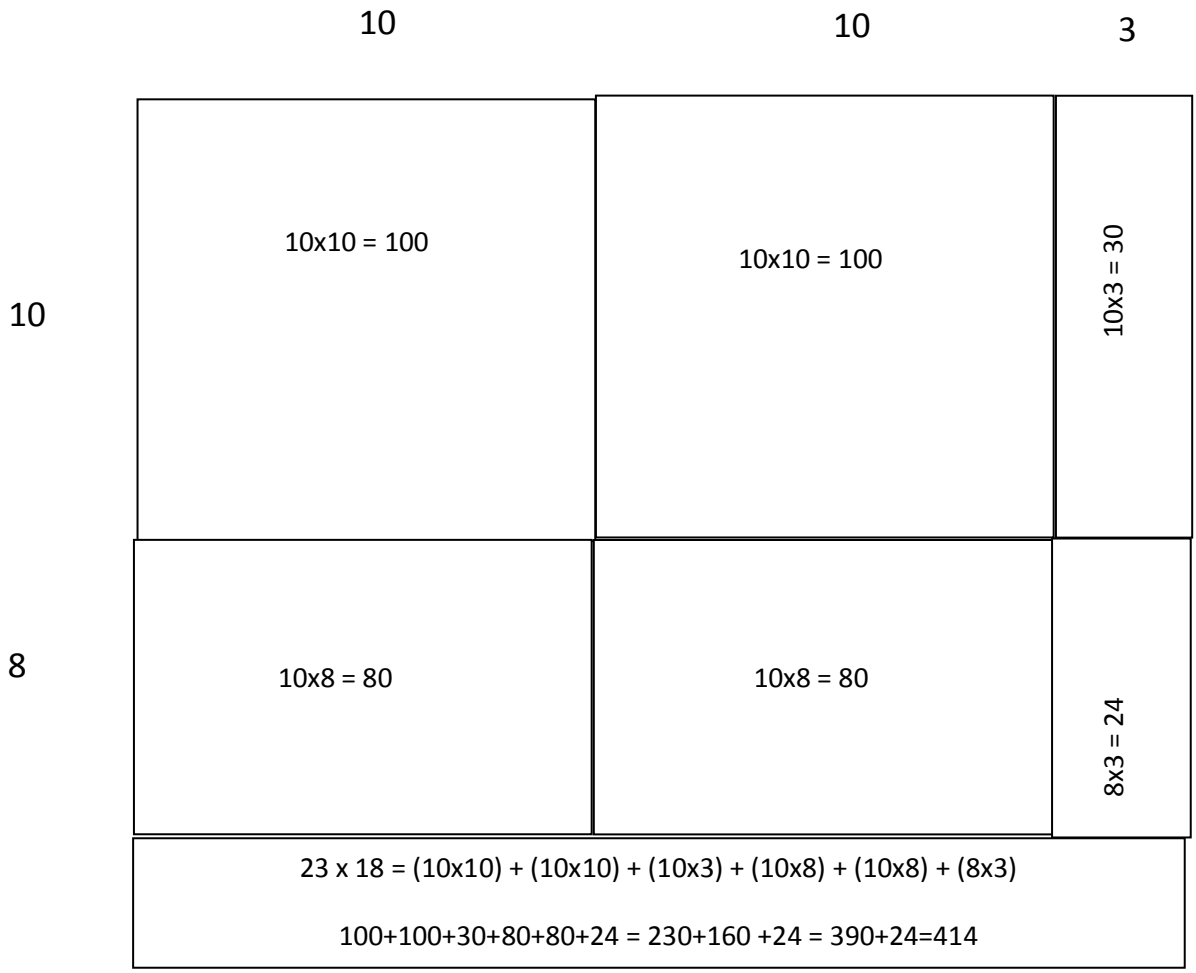
The area of a 225 by 60 rectangle (60×225) is double that of a 225 by 30 rectangle (30×225). If we scale the width of the rectangle by a factor of 2, then the area of the resulting rectangle doubles. In other words, if one of the factors of the product 30×225 is scaled by a factor of 2 then the product is scaled by a factor of 2.

7) We know 25 x 28 is larger than 24 x 28. How much larger is it. Please explain your thinking.

25 x 28 is 25 more than 24 x 28 because (24 x 28) + (1 x 28) = 25 x 28

Or students might prove using the array model.

8) Using an array model, draw and explain the structure of an algorithm for 23 x 18. One example is below.



9) Write a word problem to match 500 ÷ 29. Solve the problem and explain your thinking. Example: I had $500 dollars to spend on calculators for the school. The calculators cost $29 each. How many calculators can I buy?

500 ÷ 29 (measurement division)

$29 x 10 calculators = $290

$500 – $290 = $210 left

$29 x 5 calculators = (30 x 5) - 5 = 150-5 = $145

$210 – $145 = (210-100) – 45

110 – 45 = (110 – 10) – 35

100 – 5 = (100-30) - 5

70-5 = 65 dollars left

$29 x 2 = $58

65 – 58 = 7 dollars left

10 + 5 + 2 = 17 calculators total

CHECK: 17 x 29 = 17 x 30 – 17

17 x 3 = 17 x 2 + 17 = 34 + 17 = 51

17 x 30 = 510

510 – 17 = 510 – 10 – 7 = 493

17 calculators x $29 = $493

There would be 7$ left over.